OPERATION
AND
SERVICE MANUAL

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OPERATION
AND
SERVICE MANUAL

MODEL L-7/L-7M
T.O.S. No. 129
SERIAL NO.
PLUG-IN OSCILLATOR

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CONVERSION INFORMATION

Commencing with equipment shipped after about July 22, 1963, certain modifications have been incorporated in the Telonic SM-2000 plug-in series, and in the Telonic SM-2000 control chassis. These modifications may render the units incompatible with those previously shipped unless the earlier instruments are modified also. The equipment in which these modifications have been made can be identified by the letter "A" prefixed to the serial number.

Units not so identified must be modified if they are to be compatible with instruments now being shipped. The modifications to be made are listed below, divided into two groups - those to be made to earlier SM-2000's and those to be made to earlier plug-ins.

SM-2000 CHANGES

1. On J601, remove all wires presently connected to pin 8 and reconnect them at pin 7; remove the jumper between pins 7 and 8.

2. Using shielded wire, type RG-174/U or equal, connect pin 8 of J601 to the printed circuit board land which leads to pin 1, V303. Ground the shield by connecting it to a convenient ground land nearby.

3. Prefix the letter "A" to the serial number of the instrument.

PLUG-IN CHANGES

1. On P601 remove all wires presently connected to Pin 8 and reconnect them at pin 7; remove the jumper between pins 7 and 8 if one is connected.

2. Prefix the letter "A" to the serial number of the instrument, if none is prefixed.

Changing the serial number of the instrument is as important in the modification as are the electrical requirements, as the ability to identify a unit as having been or not having been modified is involved.

SECTION I

SPECIFICATIONS

INTRODUCTION

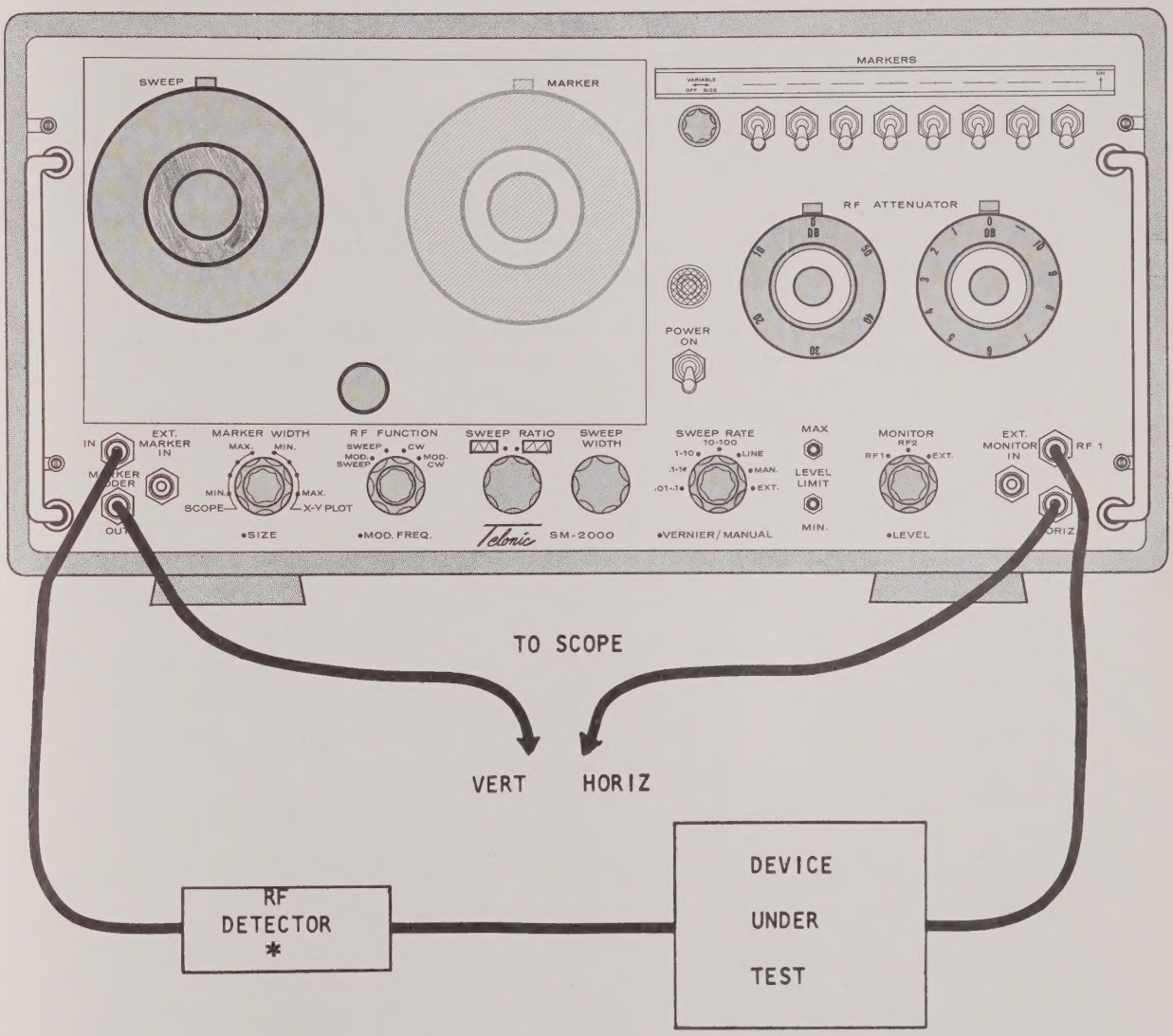
The L-7 is a plug-in sweep oscillator unit for use with the Telonic Models SM-2000 and SM-2000-1 control chassis. These plug-ins utilize the special functions of the control chassis such as choice of sweep/retrace ratio, variable sweep rate, and manual or external sweep.

The L-7M includes a variable marker covering the entire swept frequency range. This difference is clearly indicated throughout the manual.

SPECIFICATIONS

CW AND SWEEP CENTER FREQUENCY RANGE	100-210 Mc
SWEPT FREQUENCY RANGE	88-230 Mc
SWEEP WIDTH	0.1-25%
OUTPUT VOLTAGE	0.75v r.m.s.
FLATNESS	±0.25 db
LINEARITY	
At sweep width indicated not over	10%:1.2:1
At maximum specified sweep width not over	1.5:1
VERNIER LEVEL CONTROL RANGE	0-6 db
VARIABLE MARKER (L-7M only)	
Frequency range	88-240 Mc
Accuracy	±0.25%

SECTION II .. OPERATING INSTRUCTIONS



*The Telonic XD-3A or XD-8A is suitable for this use in a 50Ω system. The XD-4A or XD-9A is recommended in a 75Ω system.

DESCRIPTION OF FRONT PANEL

The front panel contains two controls (one only if variable marker is not installed).

SWEEP — The Sweep Dial, which sets the center frequency of the sweep oscillator by means of a variable capacitor.

MARKER — The Variable Marker Dial, calibrated in two ranges to cover the full range of the unit. This control also adjusts frequency with a variable capacitor.

GENERAL

1. Make sure the control chassis power is OFF before inserting the plug-in oscillator into the control chassis. If the power is ON, transient voltages may damage diodes in the units. Insert plug-in oscillator and secure it in the chassis by tightening the fastening rod with the knob in the lower center of the front panel.

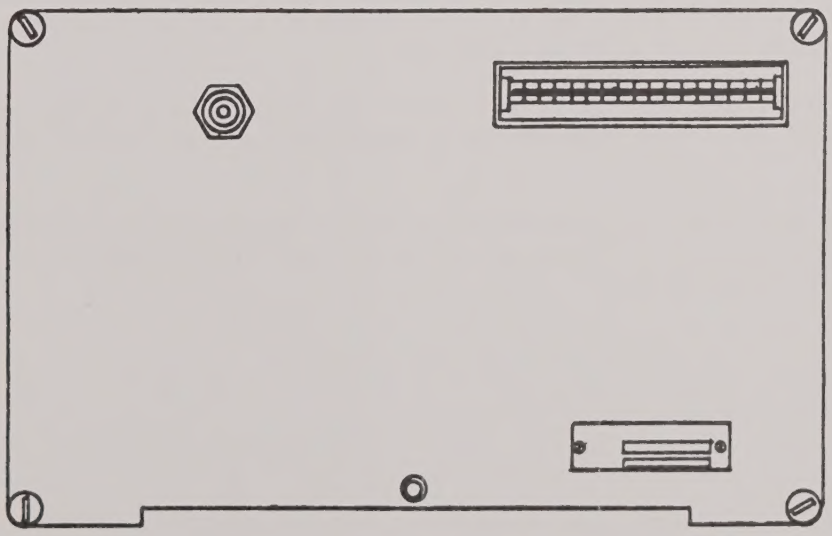
2. Make connections to the scope (or recorder), the device under test, and RF Detector as shown. All connectors located on the sweep generator are BNC type and it is recommended that RG cable be used for all connections. This insures good ground connection between the devices and minimizes hum, radiation from the unit, and pickup of spurious external signals. The cable that is used to connect RF I to the device under test should match the impedance of the sweep generator, or else a matching network should be used to insure a constant input signal.

3. Refer to the manual for the control chassis for additional instructions.

4. To insure proper operation refer to Section IV (CALIBRATION PROCEDURE). NOTE: To insure a constant amplitude signal, the LEVEL LIMIT MAX and MIN controls on the control chassis should be set as prescribed in Section IV of this manual. This adjustment varies with the individual plug-in oscillator.

5. Proceed in accordance with recommendations of the manufacturer of the device under test concerning alignment, adjustment, and tests.

DRAWING OF REAR PANEL



DESCRIPTION OF REAR PANEL

The two electrical connectors on the rear panel are:
A BNC plug, which mates with a BNC jack on the control chassis. This is the RF output connector.

A 32-contact plug which makes the other electrical contacts necessary through a mating socket on the control chassis.

SECTION III

GENERAL DESCRIPTION

SWEEP OSCILLATOR

The sweep oscillator is a modified Colpitts circuit.

The frequency is swept with a triangular or sawtooth drive (from the control chassis) to a saturable reactor which controls the inductance in the oscillator tank circuit. The oscillator tank capacity is controlled by the front panel SWEEP frequency dial.

The output is leveled by a signal from the control chassis as explained in the manual for that unit.

VARIABLE MARKER (L-7M only)

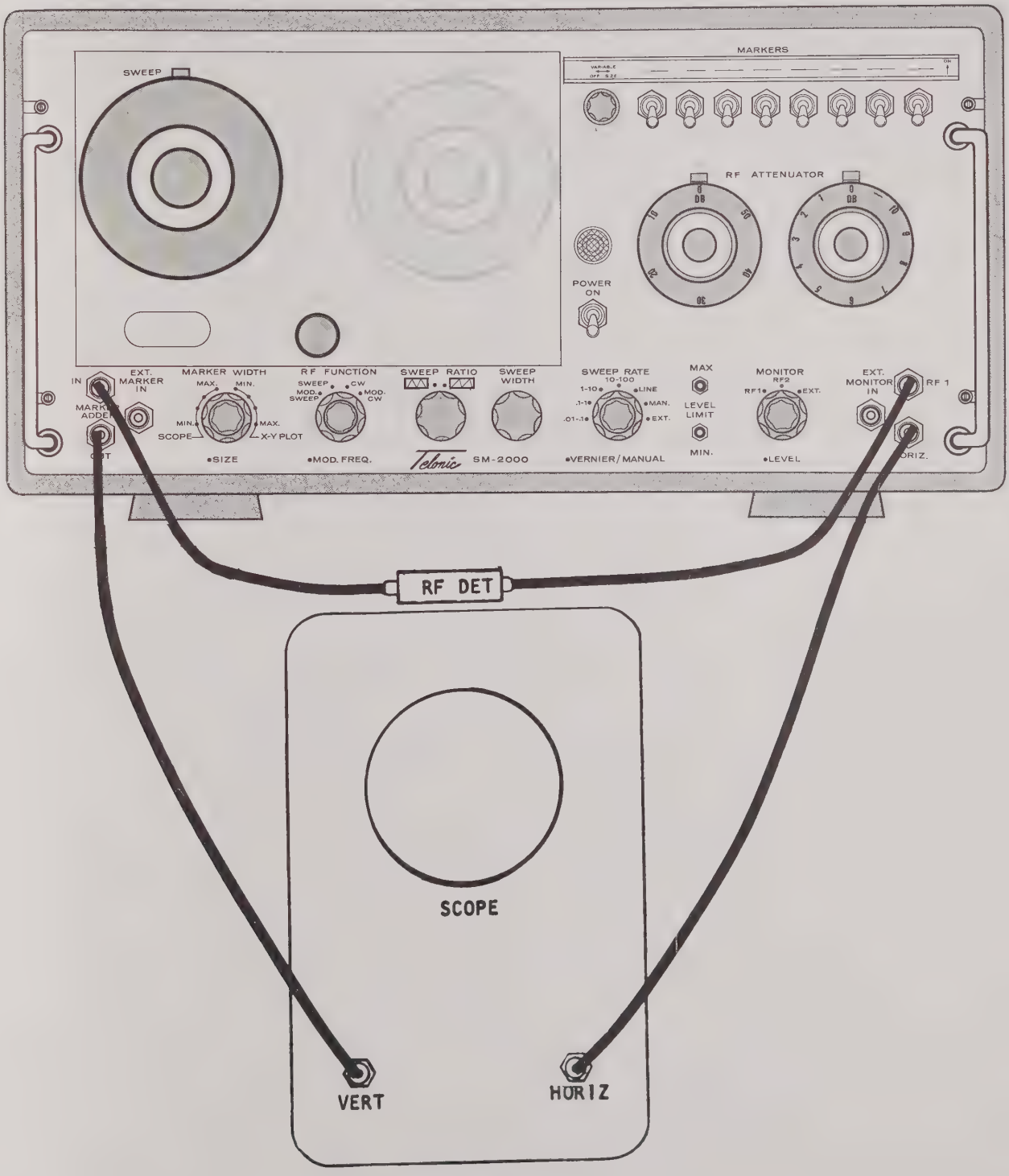
The variable marker is derived from heterodyning the fundamental or harmonic frequencies of a variable oscillator and the sweep oscillator. The marker dial is calibrated over two ranges. The outer range represents the fundamental band of the variable oscillator, which is somewhat less than that of the sweep oscillator. The inner scale is calibrated at twice the fundamental, and the two scales together extend over the full swept range.

The diode mixer circuit which combines the signals from the two oscillators is also an effective harmonic generator. Thus there will be harmonics of both the sweep oscillator output and the variable c-w oscillator output present. In the upper part of the swept range the second harmonic of the c-w signal combines with the fundamental swept signal to produce the birdy. Over the fundamental range of the c-w oscillator the birdy is produced by heterodyning the fundamental signals from both oscillators.

The mixer circuit has been optimized carefully to produce a marker of approximately constant amplitude over the full range and to discriminate against spurious markers.

The output of the mixer is coupled to the birdy-by-pass marker system of the control chassis through a filter which limits the frequencies passed to those required for a birdy marker.

SECTION IV .. CALIBRATION PROCEDURE



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GENERAL

The following procedure should be applied after changing any component in the plug in, or at any time the calibration is noted to be incorrect.

Complete calibration of the plug-in involves adjustment of three different classes of controls:

Those located in the plug-in which affect the operation of the control chassis.

Those located in the plug-in and affecting plug-in functions only.

Those located in the control chassis which affect the operation of the plug-in.

The latter class of controls is discussed in the manual for the control chassis. The others are treated here.

NOTE: Although preliminary adjustments may be made with the cover removed from the oscillator section, final adjustment requires that the cover be in place. Holes are provided in the box for access to C802 and L801. See chassis layout on next page for location of access holes.

TEST EQUIPMENT REQUIRED:

In addition, crystal-controlled harmonic markers, such as the Telonic "CDH" series, are required. A CDH-50, CDH-5.0 and CDH-2.0 are recommended.

PROCEDURE

1. Make connections as shown on page 6. Observe the instructions contained in Section II concerning type of cable.

2. With power OFF, insert the plug-in and secure it in place.

3. Turn power ON, allow a 15 minute warmup period, and make adjustments as outlined.

MINIMUM SWEEP CENTERING (Adjustment)

The MINIMUM SWEEP CENTERING Control is set for optimum dial accuracy.

1. Preset the following controls:

   Control Chassis
   SWEEP WIDTH - near minimum
   50 Mc marker ON
   Variable and other fixed markers OFF

   L-7
   SWEEP Dial to 100 Mc

2. Locate the 100 Mc marker on the display.

3. Adjust MINIMUM SWEEP CENTERING Control to center the 100 Mc marker on the scope trace.

4. Decrease sweep width, using the MINIMUM SWEEP CENTERING Control to maintain the marker in the center of the trace, until sweep width is near minimum.

5. Simularly check the dial accuracy at other calibrated frequencies, adjusting the MINIMUM SWEEP CENTERING Control to divide errors, if any, as nearly equally as possible over the range. If desired, this control may be set instead to provide best dial accuracy at a preferred frequency setting.

MAXIMUM SWEEP CENTERING (Adjustment)

The MAXIMUM SWEEP CENTERING Control is set for equal sweep on each side of center frequency.

1. Leaving other control set as at the conclusion of the MINIMUM SWEEP CENTERING adjustment, rotate the front panel SWEEP WIDTH knob fully clockwise.

2. Adjust MAXIMUM SWEEP CENTERING to center the 100 Mc marker on the trace.

SWEEP WIDTH (Adjustment)

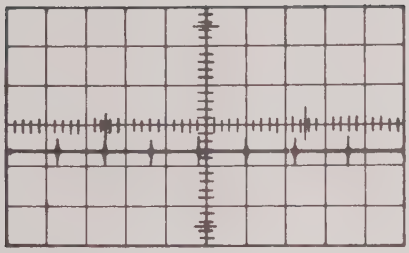
This adjustment is set to provide 25% sweep width. The percent of sweep width is constant over the L-7 range, thus will be 25% at any other center frequency.

Preset the following controls:

Control Chassis
5 Mc harmonic marker ON
Variable and other fixed markers OFF

L-7
SWEEP Dial to 160 Mc

Adjust SWEEP WIDTH on the L-7 until nine markers (140-180 Mc) appear on the display. Alternately adjust the SWEEP Dial and SWEEP WIDTH Controls on the L-7 until the 140 Mc marker is at the left end of the trace and the 180 Mc marker is at the right end.



LINEARITY

Linearity measurements are made over the center 80% of the display at maximum sweep width.

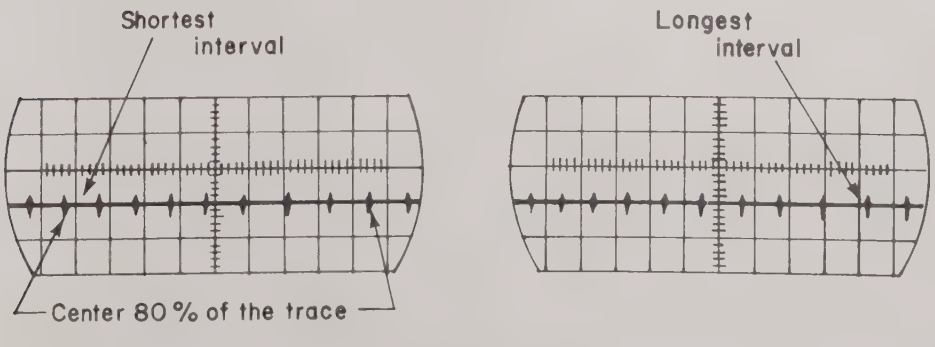
With other controls set as above turn on the 5-Mc harmonic marker for the L-7. Turn off all other markers. Set the SWEEP dial for a center frequency which will allow 10 marker intervals to occupy the full trace and adjust the horizontal gain of the oscilloscope for a 10 cm trace.

Locate the shortest and longest marker interval in the center 80% (8cm) of the oscilloscope trace. Readjust the horizontal gain of the oscilloscope so that the shortest interval occupies exactly 1 cm. Refer to illustration on the left below.

Adjust the position of the trace so that the longest marker interval begins on a graticule line and measure the length of the interval. Refer to illustration on the right below.

Its length in centimeters indicates the linearity ratio: a length of 1.15 cm for the longest marker interval represents a linearity of 1.15:1.

Linearity can be checked at other sweep widths, such as 40%, by analogous methods using either the same or other harmonic markers.



LEVEL LIMIT (MAX and MIN) (Control Chassis)

Preset the following controls on the control chassis:

LEVEL fully clockwise
SWEEP WIDTH fully clockwise
MONITOR in RF 1 position
SWEEP RATE to maximum
SWEEP RATIO to

Set the output level at exactly 1v rms with the MAX LEVEL LIMIT. Considering the efficiency of the XD-3A at this level and frequency, 1.0v rms corresponds to an XD-3A d-c output of about 1.1v. Insert fixed attenuation, not to exceed 6 dB, in an amount equal to the desired range of the LEVEL Control and note the output level. Reset the attenuators to 0.dB, and rotate the LEVEL Control fully counter-clockwise. Adjust MIN LEVEL LIMIT for the same output noted with 6 dB fixed attenuation.

FLATNESS CHECK

Flatness is measured over the entire swept range of the plug-in; in this range, the minimum output must be not more than 0.5 dB lower than the maximum output at any frequency setting.

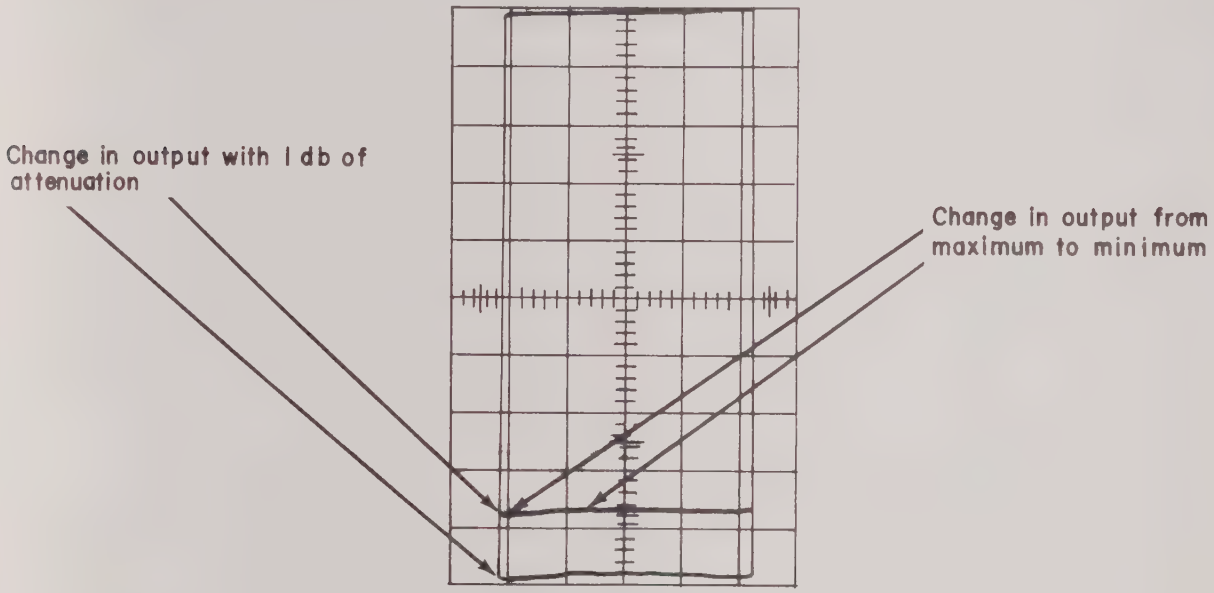
Preset the following controls:

SWEEP WIDTH fully clockwise
LEVEL fully clockwise
All markers OFF
MONITOR SELECTOR to RF 1

NOTE: Be sure that LEVEL MAX and MIN Controls are adjusted as prescribed above.

Rotate the SWEEP Dial through its calibrated range, noting the maximum and minimum outputs.

Compare the difference between these outputs with the reduction in output resulting from the insertion of 1 db attenuation. The difference between the maximum and minimum must be no greater than half the change caused by the 1 db attenuation.



VARIABLE MARKER (Adjustment)

This procedure is provided primarily to restore the dial accuracy after a component in the marker circuit is changed.

NOTE: Refer to chassis layout on page 8 for location of C804 and L801. These adjustments are made with the cover ON.

Preset the following controls:

Control Chassis

SWEEP WIDTH to approximately 10%	50-Mc Marker ON
LEVEL to maximum	5-Mc Marker ON

Plug-in

SWEEP dial and MARKER dial to the lowest frequency calibrated on outer scale of MARKER Dial.

Adjust L801 to superimpose the variable marker over the crystal-controlled marker at this frequency.

Reset the plug-in SWEEP and MARKER dials to the highest frequency calibrated on the outer scale of the MARKER dial.

Adjust C804 to superimpose the variable marker over the crystal-controlled marker at this frequency.

Repeat the above procedures until the markers are superimposed at each end of the frequency range each time the dials are set as prescribed. If preferred, dials errors can be divided over the full range instead, or a critical frequency can be favored with best accuracy.

SECTION V
MAINTENANCE

GENERAL PROCEDURE

Since this model is a plug-in unit, many of the possible malfunctions of the oscillator are the result of part failure in the control chassis. The connections at P601 of the plug-in and at J601 of the control chassis afford a convenient means of tracing the source of troubles to the oscillator or chassis.

In locating troubles which have been traced to the oscillator, application of the common rules of electronic maintenance, including a visual check for damage, open filaments, glowing anodes, shorted tuning capacitors, and charred resistors, is an obvious measure. All connectors, particularly P601 and J601, should be checked for cleanliness.

EXTENSION CABLE

For maintenance work requiring access to parts located on the under side of the plug-in, or in other areas not easily reached, an extension cable may be obtained from Telonic Industries, Inc. This cable, having the 32-contact plug on one end and the 32-contact jack on the other, allows the plug-in to be removed from the control chassis and operated on the bench.

ACCESS TO R-F COMPARTMENT

There are four unlacquered screws on the cover to the r-f compartment. Only these should be removed in taking off the cover.

The lacquered screws hold the shield in place and have nothing to do with securing the cover.

The following chart will be of service in deciding whether a trouble lies in the oscillator or control chassis.

SYMPTOM	CHECK (on P601)
Weak or no output or unleveled output	DC voltage at Pin 31 with RF LEVEL fully clockwise
No sweep width	1. Voltage waveform, Pin 14 to ground.
	2. Next - resistance between Pins 14 and 15, 28 and 29, 30 and 4 with plug-in removed.
Changing sweep width also changes center frequency	Resistance from Pin 28 to Pins 5, 29, and 16 with plug-in removed.
No variable marker	1. For birdy at Pin 17
	2. DC voltage at Pin 1

If the chart shows that the trouble probably is in the control chassis, refer to the Maintenance Section of the manual for that unit.

If the trouble appears to be in the plug-in, the following chart may be of assistance in localizing the failure:

SYMPTOM	CHECK
Weak or no output or unleveled output	V701 and associated circuitry. Continuity from Pin 31 of P601 to Pin 1, 6, or 7 of V701.
No sweep width	Check R602, R603, R605, and L701A.
Changing sweep width changes center frequency	Check R601, R604 and R606 first for open, second for changed value.
No variable marker	Check V801 and associated circuitry, including sweep sample line. Change diode in mixer circuit and check other mixer components.
Weak Marker	Diode in mixer circuit. V801 and associated circuitry. Sweep sample line. If markers on one range are considerably more prominent than those on another, substitute diodes to optimize all.
Spurious Markers	Check mixer diode and change if necessary. Be sure diode is inserted with correct polarity.

It is assumed that the above procedures have been applied and that the jumpers on P601 are intact. Where "inconclusive" is shown, the next step should be followed.

IF RESULT IS	TROUBLE PROBABLY IN	
	OSCILLATOR	CONTROL CHASSIS
High 100-175v	x	
Low or zero 0-100v		x
Sawtooth or triangular waveform OV or DC voltage	x Inconclusive - see check #2	
Open on any check	x	
Continuity		x
Open on any check	x	
Continuity		x
Birdy present		x
No birdy	Inconclusive - see check #2	
100V	x	
Low or no voltage		x

SCHEMATIC PART DESIGNATION

C	Capacitor
CR	Semiconductor diode
J	Jack
L	Inductor
P	Plug
R	Resistor, Fixed or Variable
V	Tube

SCHEMATIC VALUE ABBREVIATION

Ω	ohms	
K	1,000 ohms	
M	1,000,000 ohms	(megohms)
µf	Microfarad	
pf	Picofarad	
µh	Microhenry	
mh	Millihenry	

OTHER ABBREVIATIONS

F.P.	Front Panel
R.P.	Rear Panel
T.P.	Test Point

RESISTORS - All resistors are 1/2 watt, ± 10%, and are shown in ohms, unless otherwise specified.

CAPACITORS - All capacitors are shown in picofarads (pf) unless otherwise specified.

COILS - All inductors are shown in microhenries (µh) unless otherwise specified.

CIRCUIT REFERENCE SYMBOL - LOCATION INFORMATION

601 - 699	Interconnecting elements	701 - 799	Sweep Oscillator
		801 - 899	Variable Marker

* Indicates value of component adjusted at factory, and may deviate from value shown on print.

SECTION VI

PARTS LIST

Circuit Reference No.	Description	Telonic Part No.
C601	CFC (SC)	NA
C701	CVA, 40pf	C-424
C702	CFC, 15pf, ±10%, 1000VDCW	C-7
C703	CFCF, 1000pf, +100-0%, 500VDCW	C-110
C704	Same as C703	
C705	Not used	
C706	Feedthru, Low-Capacity	MP-42
C707	Same as C703	
C708	Same as C703	
C709	Same as C703	
C710	CFC, 5pf, ±10%, 1000VDCW	C-4
C711	Same as C703	
C712	CFC 10pf	C-6
J701	RJ, BNC	J-7
P601	Plug, 32-contact	S-39
P701	PC, UG-88C/U	J-13
P702	PC	J-27
L701	Reactor, saturable	09105
L702	IF, 2.2µh	L-100
L703	Not used	
L704	IF, 4.7µh, ±10%	L-105
L705	IF, 2.2µh, ±10%	L-101
L706	Same as L705	
L707	IF, 0.68µh	L-103
R601	RVC, 50KΩ, 2W	R-751
R602	RVC, 250Ω, 2W	R-771
R603	Not used	
R604	Not used	
R605	RVC, 250KΩ, 2W	R-752
R606	RFC, 68KΩ, ±5%, 1/2W	R-51
R608	SC	
R609	RFC, 33KΩ, ±10%, 1/2W (SC)	R-36
R610	SC	
R611	SC	
R701	RFC, 2.7KΩ, ±10%, 1/2W	R-114
R702	RFC, 5.6Ω, ±5%, 1/2W	R-1
R703	Not used	
R704	RFC, 39KΩ, ±10%, 1/2W	R-26
R705	RFC, 5.6Ω, ±5%, 1/2W	R-1
V701	TE, 6DZ4	VT-51*

PARTS LIST (Cont)

VARIABLE MARKER

Circuit Reference No.	Description	Telonic Part No.
C801	CVA, 140pf	C-422
C802	CFC, 75pf, ±10%, 1000VDCW	C-12
C803	Same as C802	
C804	CVC, 3.5-13pf	C-436
C805	CFC, 15pf, ±10%, 1000VDCW	C-7
C806	CFC, 0.01μf, +80-20%, 500VDCW	C-20
C807	CFCF, 1000pf, +100-0%, 500VDCW	C-110
C808	Same as C807	
C809	Same as C807	
C810	Same as C807	
C811	Same as C806	
C812	Same as C807	
C813	Same as C807	
C814	Same as C706	
CR801	DS, IN82	D-1
L801	IV	34006
L802	IF, 55μh	L-108
L803	IF, 2.2μh	L-100
L804	IF, 2.2μh, ±10%	L-101
R801	RFC, 2.2KΩ, ±10%, 1/2W	R-20
R802	RFC, 51Ω, ±5%, 1/2W	R-3
R803	RFC, 100Ω, ±10%, 1/4W	R-1421
R804	RFC, 2.7Ω, ±10%, 1/4W	R-1429
R805	RFC, 3.3KΩ, ±10%, 1/2W	R-70
R806	RFC, 10KΩ, ±10%, 1/2W	R-23
V801	TE, 6DZ4	VT-51*

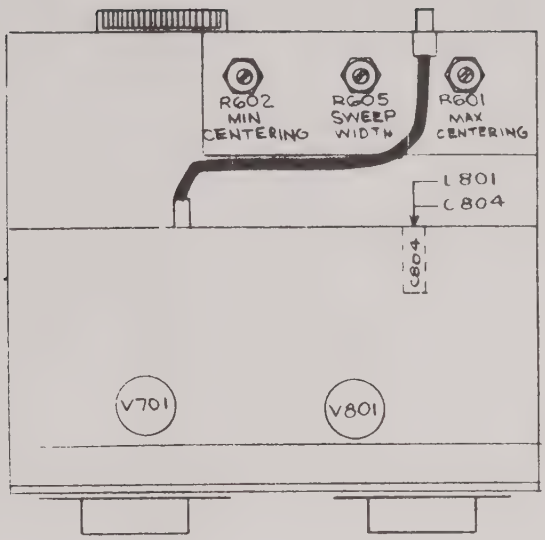
*TE, 6AF4, Telonic part number VT-4 are used as an alternate in this unit.

ABBREVIATION CODE

CFC	Capacitor, fixed, ceramic
CFCF	Capacitor, fixed, ceramic feedthru
CVA	Capacitor, variable, air
CVC	Capacitor, variable, ceramic
DS	Diode, semiconductor
IF	Inductor, fixed
IV	Inductor, variable
NA	Not assigned
PC	Plug, cable
RFC	Resistor, fixed, composition
RJ	Receptacle, jack
RVC	Resistor, variable, composition
SC	Subject to change
TE	Tube, electron

SECTION VII

SCHEMATIC DIAGRAMS



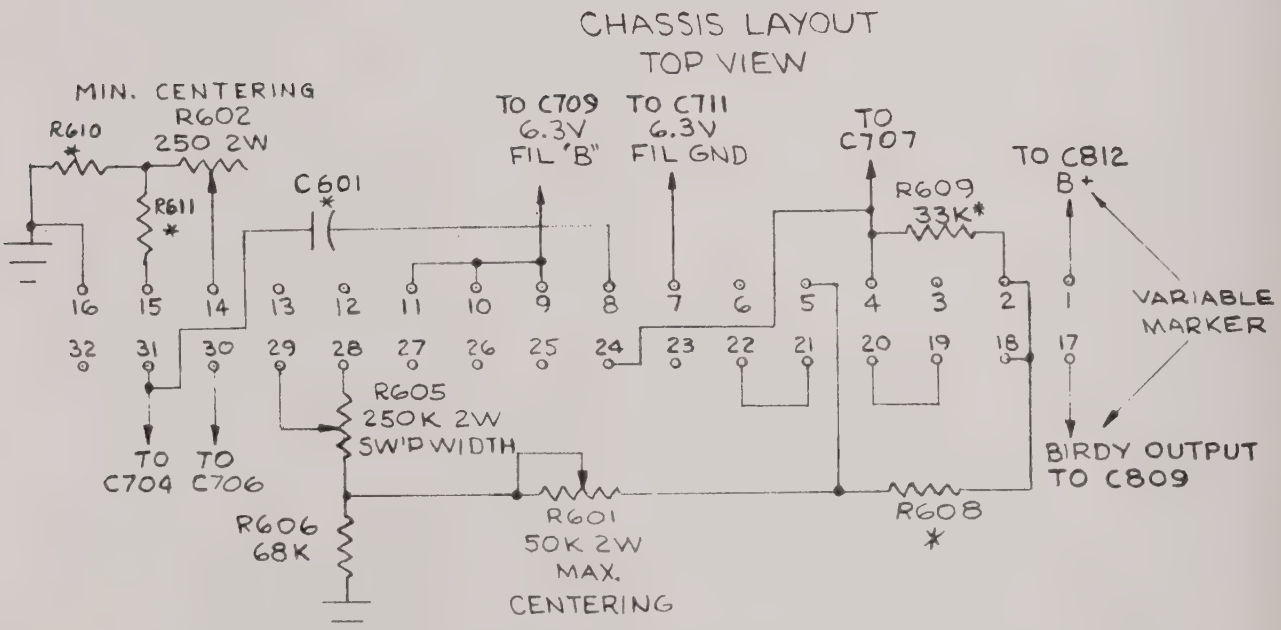


Figure 1 L-7/L-7M P601 Schematic

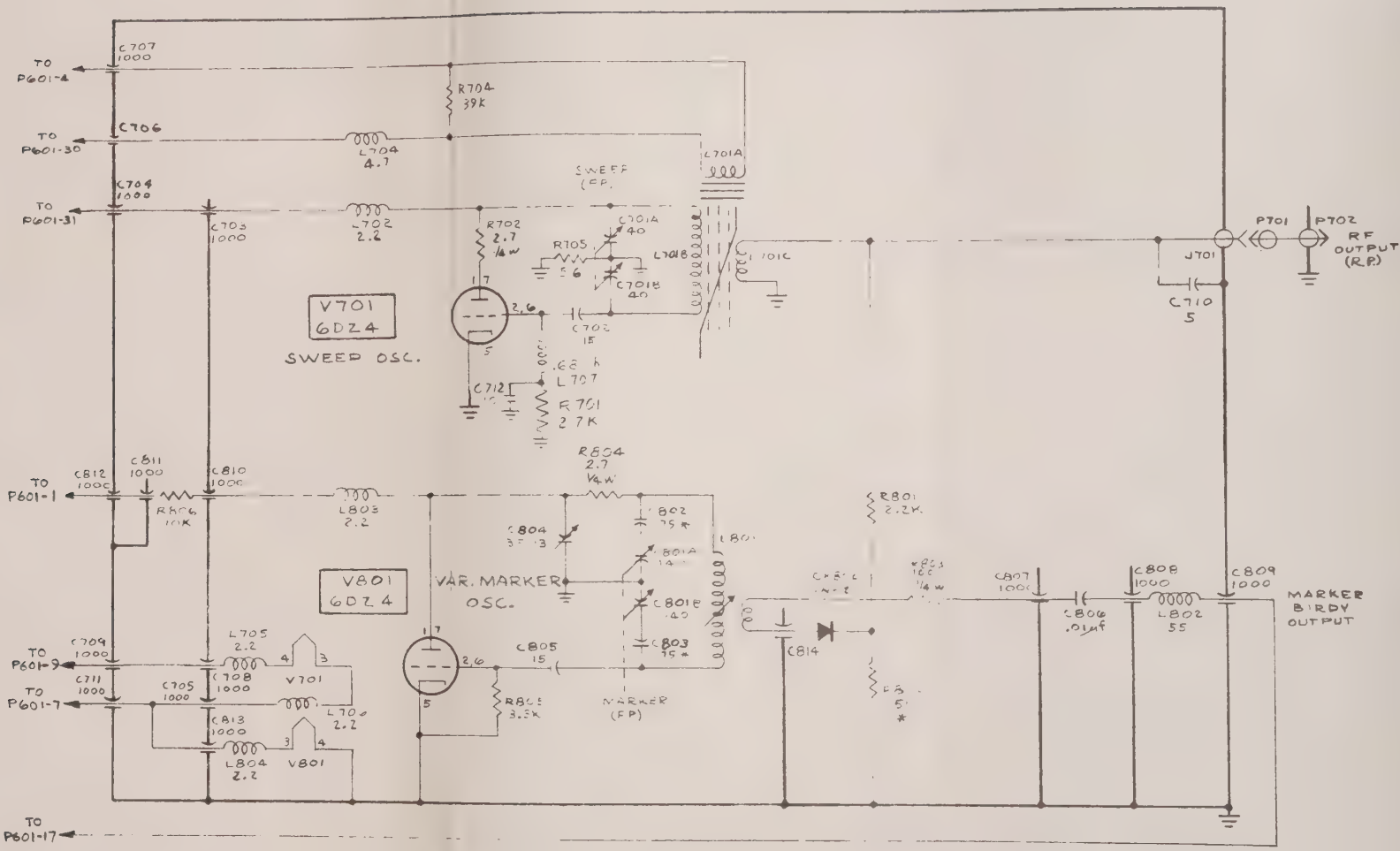


Figure 2 L-7/L-7M Oscillators Schematic

WARRANTY

TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

CUSTOMER RETURN OF EQUIPMENT (REPAIR, REPLACEMENT, DUPLICATION, CREDIT, OTHER)

All customer returns require authorization from Telonic Industries, Inc. prior to shipment of equipment. Any equipment returned without authorization for shipment will be at the customer's or distributor's expense.

Instructions for Returning Equipment To Telonic:

1. Contact factory with details of part number, serial number, original purchase order number and reason for return.

2. Telonic will issue instructions on returning the material to the factory or to our regional repair facility. "Please do not return instruments or parts before receiving directions." This will assure you the fastest possible service on Telonic products.

3. Customer is expected to ship all returns prepaid freight. Material will be returned via same shipping method as received unless otherwise instructed.

Units will be shipped "Prepaid"....In Warranty and
"Collect"....Out of Warranty.

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